

New Particle Formation Working Group

Paul Doskey

Barbara Finlayson-Pitts

Robert McGraw

Peter McMurry, Chair

Jim Smith

McKenzie Smith

Fangqun Yu

Question 1: What are the major uncertainties in understanding (or model/theoretical representation) of NPF that have the most impact as regards climate forcing?

- ◆ Vertical Distributions of Formation-Mixing effects
- ◆ Formation in Cloud Outflows
- ◆ Emissions
 - Primary particles (A_{Fuchs})
 - Gas Phase Precursors (NH_3 , amines (?), VOC)
- ◆ Theory(s) for J
- ◆ Mechanisms for dD_p/dt (GR)

Question 2: How is our current portfolio of ASP projects addressing these uncertainties to improve this state of knowledge?

Good

- ◆ dD_p/dt (GR)
 - TDCIMS: Species contributing to growth
 - Nanoparticle size distributions
- ◆ J: Field observations; Theory
- ◆ Spatial distributions: Measurements at diverse sites (ground-based)

Opportunities

- ◆ Cloud Outflows: Largely neglected, likely to be important
- ◆ dD_p/dt : Predictions by existing SOA models (easy & worthwhile)
- ◆ Emissions: A common theme
- ◆ Coordination of ground-airborne measurements

Question 3: Who else (outside ASP) is addressing this problem?

There is a relatively small community of researchers working on this problem, and we are reasonably well connected. We meet in international workshops every few years and we share data and ideas.

Question 4: Are there any areas where improved coordination within our ASP project portfolio (or with others) would be beneficial? If so, what should be done and by whom?

- ◆ Integrate aircraft and ground-based studies of NPF
 - Vertical distributions
 - Regional uniformity and extent
 - Cloud outflows
- ◆ Integrate measurements of gas-phase precursors
- ◆ Focused themes, e.g.:
 - Biogenic effects
 - Anthropogenic SO₂-driven
 - DMS-driven
- ◆ Closer coordination with modeling community

DOE NPF WG Charge

Question 1

- ◆ What are the major uncertainties in understanding (or model/theoretical representation) of NPF that have the most impact as regards climate forcing?

DOE NPF WG Charge

Question 2

- ◆ How is our current portfolio of ASP projects addressing these uncertainties to improve this state of knowledge? (Are there changes in direction or emphasis that you believe DOE should consider?)

DOE NPF WG Charge

Question 3

- ◆ Who else (outside ASP) is addressing this problem?

DOE NPF WG Charge

Question 4

- ◆ Are there any areas where improved coordination within our ASP project portfolio (or with others) would be beneficial? If so, what should be done and by whom?

DOE New Particle Formation (NPF)

Working Group Members (as of 10/26/06)

<u>Name</u>	<u>Affiliation</u>
Cynthia Atherton	Lawrence Livermore Lab
Fred Eisele	NCAR
Jerome Fast	PNL
Barbara Finlayson-Pitts	UC Irvine
Jose Jimenez	UC Boulder
Chuck Kolb	Aerodyne
Sasha Madronich	NCAR
Bob McGraw	BNL
<i>Peter McMurry, Chair</i>	U. Minnesota
William J. Shaw	PNL
Jim Smith	NCAR
Doug Worsnop	Aerodyne
Doug Wright	BNL
Rahul Zaveri	PNL
Renyi Zhang	Texas A&M

International NPF Working Group

- ◆ Markku Kulmala and Peter McMurry, co-chairs
- ◆ First Meeting: Hyytiälä, Finland, Aug. 15-17, 2005
50 participants from Austria (1), Belgium (1), Czech Republic (1), Estonia (2), Finland (18), Germany (6), Ireland (1), Italy (2), South Africa (1), Sweden (3), Switzerland (1), UK (4) and US (9)
- ◆ Second Meeting: Minneapolis, MN, Sept. 9-10, 2006
 - For Abstract book see: <http://www.me.umn.edu/aerosol/>
- ◆ Third Meeting: ICNAA, Galway, Ireland, Aug 13-17, 2007

DOE NPF Deliverables:

Instrumentation

- ◆ Thermal Desorption Chemical Ionization Mass Spectrometer (TDCIMS) for measuring composition of nanoparticles down to ~6 nm
 - Organics, inorganics (NCAR/UMN team)

DOE NPF Deliverables: Process Models for *New Particle Formation* and *Growth Rates*

- ◆ Parametrized expressions for *NPF Rates*
 - Sensitivity to $[H_2SO_4]$, organic acids, ions, $[NH_3]$, preexisting aerosol, etc.
 - Theory (McGraw), Laboratory measurements (R. Zhang, Finlayson-Pitts, McMurry), and Atmospheric observations (McMurry et al.)
- ◆ *Growth rates* of freshly nucleated nanoparticles (NCAR/UMN team; Aerodyne)
 - Contributions of H_2SO_4 & organics

DOE NPF Deliverables:

Chemical Transport Models for Aerosols

- ◆ Atherton, Fast, Wright, Madronich, McMurry (in collaboration with Y. Zhang, T. Russell and others)
 - Number concentrations (NPF Rate)
 - Mean size (growth rate) and size distribution

DOE NPF Deliverables: Atmospheric Observations

◆ Examples of Measurements

- *Aerosol*: PSD >3 nm, ions (0.5-6 nm), composition (TDCIMS, AMS), Nano TDMA,
- *Gas*: [H₂SO₄], [NH₃], organics (PTRMS)

◆ Field Study Locations

- Boulder, CO (2005-2006)
- Mexico City (2006)
- Forested Site (UMN/NCAR) (2007)